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## Aging and the Inherited Wealth of Nations

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A large, stylized number '50' is rendered in a golden-yellow color, with the '5' and '0' overlapping. The '5' is positioned above the '0'. The number is set against a light blue background with a subtle gradient and a faint, larger-scale version of the '50' graphic.

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# Aging and the Inherited Wealth of Nations\*

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## 1 Introduction

An important premise of the modern capitalism is the idea that anyone, regardless of her parents' wealth, can become rich with the right entrepreneurial skills. A recent surge of self-made billionaires is often considered to be the proof of this. For instance, Kaplan and Rauh (2013) report that the Americans who grew up wealthy in the Forbes 400 list, which provides a list of the wealthiest people ranked by net worth, fell from 60 percent to 32 percent between 1982 and 2011.

Notwithstanding this observation, however, Thomas Piketty and his coauthors have argued that the role of inherited wealth is on the rise in advanced economies. Piketty and Zucman (2014) show that although the inherited share of total wealth decreased steadily from the beginning of the 20th century until 1970s in Europe (Figure 1 for France, UK and Germany), it began to increase again after that, a trend that continued till now. Accordingly, the earlier reduction was

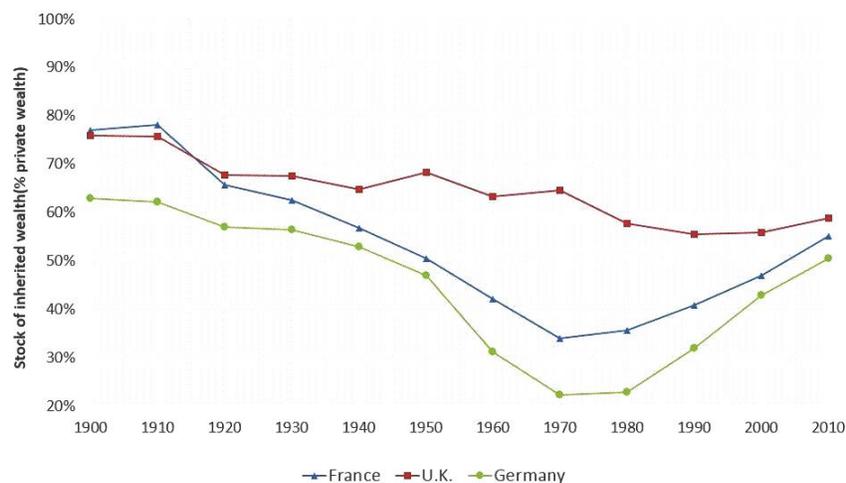
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Figure 1: Evolution of the share of inherited wealth in total private wealth (ISW), 1900-2010

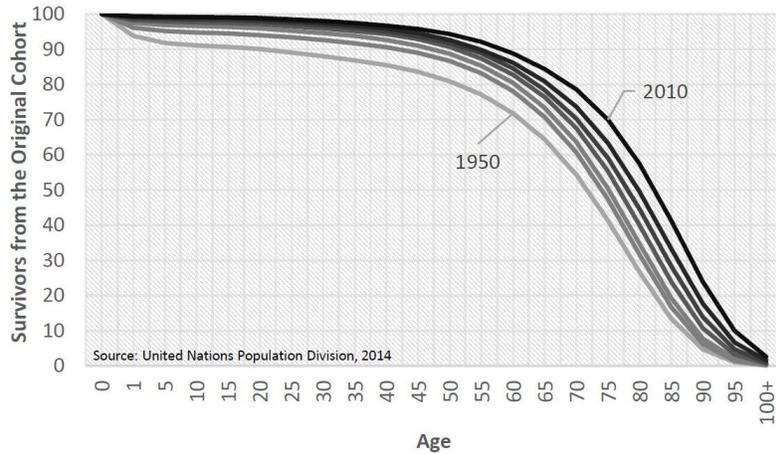


Source: Piketty and Zucman (2014).

driven by wars in the first half of the century, which impoverished the population across the board. Those who died between 1950-1960 were reported to be the least wealthy in the 20th century. The increase in the inherited share of total wealth, on the other hand, stems from increasing *inter vivos* gifts. Although it is not clear why such gifts started increasing, Piketty and Zucman (2014) suggest that longer lives may have induced parents to transfer a portion of inheritance sooner to help their offspring. We can infer from this argument that the total bequeathed wealth (inheritance and *inter vivos* gifts) have also increased as a response to longer lives, which is the main motivation for our discussion here.

Demographic aging, indeed, provides a natural suspect for the increasing share of inherited wealth. Decreasing mortality and fertility rates, both of which leads to an increase in average age in a society, have lead to dramatic changes in demographic structure of societies, especially in high income countries, in recent decades. Figure 2 shows the survival curves from 1950 to 2010. Accordingly, a 60 years old person could expect to live about 17 more years in 1950. She can expect to live about 23 more years nowadays. Accompanying the decrease mor-

Figure 2: Evolution of survival rates in high income countries, 1950-2010



tality, and perhaps more importantly, fertility rate fell from about 3 children per woman to 1.8 children per woman in the same period. As a result, the share of older people (aged 60 years or over) in society (old age dependency ratio) increased from about 12 per cent to nearly 22 per cent within 6 decades. Obviously, this demographic transformation should lead to some adjustments in wealth and income structure of the economy.

In this paper, we study how demographic aging could explain the evolution of inherited wealth over time<sup>1</sup>. In particular, we are interested in shedding light on effects of a decrease in fertility and of an increase in longevity on three commonly used indicators about the relationship between inheritance and wealth:

1. Inherited share of total wealth (ISW),
2. The ratio of inheritance to real wages (RIW), and
3. Inherited wealth inequality (IWI).

In contrast to the implication made by Piketty and Zucman (2014), we find that aging in either form, a decrease in fertility or an increase in longevity, is

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<sup>1</sup>See also Weil (1996)

not likely to explain the U-shaped pattern in the inherited share of total wealth in advanced economies. Both types of aging lead to a decrease in ISW. This is primarily because intentional bequests fall following a decrease in fertility, and although accidental bequests become larger with decreasing mortality, they also become less frequent, which dominates the effect on size.

Our results also suggest an alternative mechanism that could generate such a U-shaped pattern of the ISW after the Second World War: the rise and fall of retirement annuities. In many high income countries, public and private defined benefits systems took up after the second world war and the benefits provided by these systems increased steadily for several decades. Our simulations show that, other things being equal, an increase in such annuitization could lead to a decrease in the ISW. Interestingly, however, the annuitization trend was reversed towards the end of the century, following a shift from defined benefit to defined contribution pensions.<sup>2</sup> Thus, the rebound of the ISW could be driven by such a progressive abandonment of annuitized retirement savings.

This paper continues with a discussion on how aging affects bequeathing at individual level in the next section. In section 3 we consider the effects of aging on economy-wide indicators of inherited wealth with and without annuitization. The last section provides some concluding remarks.

## 2 Aging and Bequeathing

In order to understand how demographic aging may change bequeathing, we need to understand why bequests occur in the first place. However, untangling the motives behind any transfer of wealth from a parent, dead or alive, to a child is a daunting task. The first distinction we should be aware of is whether the transfers are intentional or not. For instance, we may not know whether a bequest is left accidentally, because of the incompleteness of annuity markets, or intentionally, that is based on some type of altruism. Similarly, in the case of

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<sup>2</sup>On this point, see Munnell et al. 2014.

*inter vivos* gifts, it may be unclear whether the transfers are “true gifts” induced by altruism, or they involve some sort of exchange, *i.e.* the donee provides some services like providing care to the donor. Thus, we shall inquire about each case separately. In a companion paper (Onder and Pestieau, 2016a) we study the impact of a decline in fertility and of an increase in longevity on the level of wealth transfers more formally. In this short paper, we will just give some of the results that arise from such an analysis<sup>3</sup>.

## 2.1 Intentional bequests

There are three major motives that can be classified as intentional, which are explained as follows.

***Pure dynastic altruism (altruistic bequest):*** This represents a case where parents care about the likely lifetime utility of their children and hence about the welfare of future generations. Accordingly, wealthier parents make larger bequests, and holding parent’s wealth constant, children with higher labor earnings will receive smaller bequests. There is also a tendency for parents to leave different amounts to different children in order to offset income inequality among them. With pure altruism, we are in the framework of Ramsey’s optimal saving model that ends up with the modified golden rule in steady state. As a result, capital accumulation and inheritance depend on both social rate of discount and population growth rate. Whereas a decline in fertility could foster wealth transfers, changes in longevity do not play a major role.

***Joy of giving (paternalistic bequest):*** In this case, parents are motivated not by altruism but by a direct utility they receive from the act of giving. This phe-

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<sup>3</sup>Note that, we assume exogenous demographics in our analysis. It is clear that if both longevity and fertility were made endogenous, some of the results would have to change depending on the factors determining fertility and mortality. See on this Zhang et al. (2001) and Leroux et al. (2011). But such considerations go beyond the scope of this paper.

nomenon is also known as “warm glow” giving and can be explained by some internal feeling of virtue arising from sacrifice in helping one’s children or by the desire of controlling their life. *Ceteris paribus*, these bequests are subject to income and price effects but do not have any compensatory effect, namely they are not intended to smooth consumption across generations. With this motive we expect the number of children to play a key role if the joy of giving arises from the per-child bequest rather than the overall bequest.

***Exchange-related motives (strategic bequests):*** In their canonical form, exchange related models consider children choosing a level of “attention” to provide to their parents and parents remunerating them with the prospect of bequest. The exchange can involve all sorts of non-pecuniary services and they can be part of a strategic game between parents and children. Strategic or exchange bequests depend on the wealth and the needs of the donor; they are not compensatory between parents and children and they do not need to be equal across children. The effect of aging on the size of the transfer depends on the specification of the model. In general, we expect that a longer life calls for more filial attention and, in return, more bequests. The impact of fertility is less clear. For example, in the strategic bequest example going from two to one child makes a big difference as the parents lose part of their bargaining power and have thus to increase the level of their gifts to get a certain level of attention.

Note that these motives can explain both bequests at the end of life and *inter vivos* gifts with the exception of strategic bequests, which only concern wealth transfers made at the very end of life. The motives so far concern voluntary transfers; next, we briefly introduce the unintentional, or accidental, bequests.

## **2.2 Accidental bequest**

The other type of bequest we consider is the unplanned or accidental ones, which result from a traditional life-cycle model. Accordingly, people save during their working lives in order to finance consumption when retired. Bequests occur

solely because the life span of some individuals happen to be shorter than they anticipated ex-ante, hence the “accidents”. A necessary condition for such bequests to occur is that wealth should be held in bequeathable form that are transferable to the donee like money or certain forms of assets. Thus, imperfections in annuity markets are implied.

With accidental bequests, we expect the effects of aging to be the opposite of those with pure altruism. The fertility rate should not play a direct role, but as the survival probability increases, we should observe larger (but also less frequent) accidental bequests.

### **3 Aging and Inherited Wealth**

We now focus on economy-wide implications of demographic aging and associated changes in individual bequests. In addition to affecting bequests, demographic aging also changes individual savings, capital per worker, and wage and interest incomes. Thus, we should take these effects into consideration. This requires us to specify the bequest mechanism explicitly.

We draw our results from Onder and Pestieau (2016b), where we use a simple Diamond-style overlapping generation model to investigate the effects of aging on bequeathing. In that model, individuals are assumed to live two periods, consuming in both, providing some labor in the first one. They retire in the second period, the length of which is not known ex-ante. There is a certain probability to survive the first period. Population is increasing at a predetermined rate.

As it is not feasible, or meaningful, to include all motives into the same model at once, we focus on two types of bequests: accidental bequests and joy of giving related bequests. Individuals can derive some utility from transferring resources to their offspring. Thus, they save in the first period to finance their consumption in old age and to leave a bequest. As annuity markets are incomplete in case of premature death, their children will inherit both the intended bequests but also the forgone second period consumption of their parents. We assume quasi-linear

utility for the first period consumption so as to keep wealth distribution within a given reasonable range. Also we introduce a given scheme of annuities, which may come from either social security or from defined benefit pensions.

In what follows, we discuss the comparative statics exercises from this model to assess the effects of decreasing fertility rate and mortality (which is equivalent to an increase in longevity) on i) the inherited share of wealth (ISW), ii) inheritance to real wage ratio (RIW), and iii) inherited wealth inequality (IWI). As it turns out, the presence and the extent of annuity schemes like defined benefit pensions has a great role in determining how these indicators behave in aging societies.

### 3.1 Absence of annuity schemes

When annuity schemes do not exist all savings are bequeathable. Our stylized specification leads to the following analytical results in such a case.

**Result 1.** *The inherited share of total wealth decreases when mortality or fertility decreases.*

This is the most important and rather robust result of our analysis. A decrease in fertility or an increase in longevity have a depressive effect on the relative importance of inheritance in wealth accumulation. Thus, this finding result does not support Piketty and Zucman's argument in this case.

**Result 2.** *Intentional bequest to wage ratio decreases and accidental bequest to wage ratio increases with a decrease in fertility. However, they are both unaffected by changes in the mortality rate.*

**Result 3.** *Inequality of inherited wealth increases when fertility decreases. The effect of mortality is non-linear. Starting from high mortality (short longevity), a small decrease in mortality increases the inequality of wealth. The effect is, however, the opposite if the starting mortality level is low.*

Note that the third result is determined by how we specify the uncertainty in the case of mortality and how we measure inequality. For the former, we assume

a predetermined probability of having a full life span. For the latter, we use a variance based indicator (coefficient of variation) to measure the dispersion. In this case, it is known that the highest variance is reached when the probability of survival is equal to 0.5.

Next, we introduce the case with annuities.

### 3.2 Presence of annuity schemes

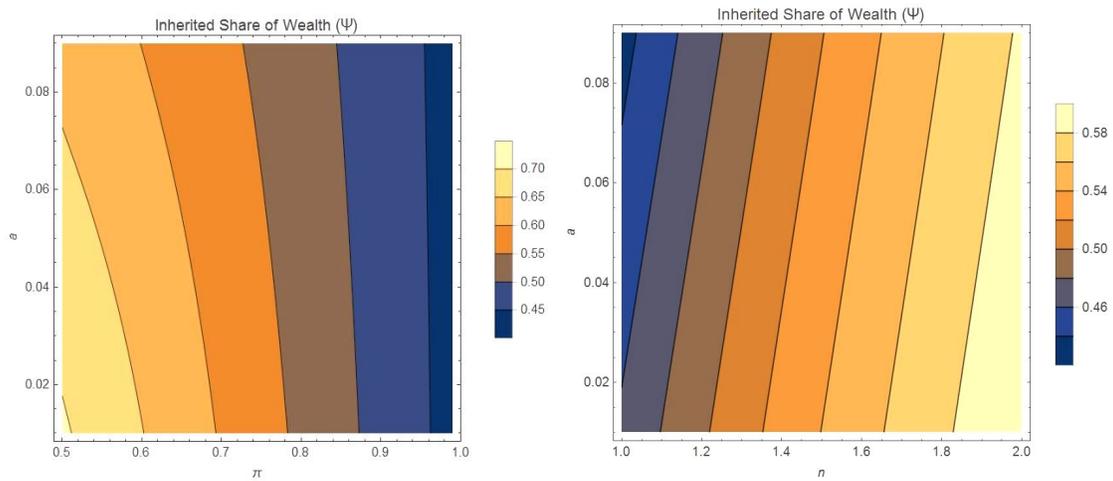
Introducing annuities complicates the analysis, and we are no longer able to produce analytical results. Thus, we adhere to using numerical simulations with a wide range of parameter/variable values. The results are as follows:

**Result 4.** *Demographic aging decreases the inherited share of wealth (ISW).*

Figure 3 shows the effects of decreasing mortality and fertility on the ISW. As the color shifts from dark blue to light yellow in the graphs, the ISW increases. Both decreasing mortality and decreasing fertility reduces the ISW, however, for different reasons. Changes in fertility mainly affect the ISW through intentional bequests. The higher these bequests vis a vis the voluntary savings, the higher the ISW. When fertility decreases, the number of children who benefit from bequests decreases. This naturally reduce the total intentional bequest each parent desires to leave. The decrease in fertility also reduces the voluntary savings because fewer children would benefit from them if they're bequeathed accidentally. However, this effect is relatively small as accidental mortality is not a sure thing. As a result, with decreasing fertility, intentional bequests decrease faster than voluntary saving, reducing the intentional bequest to voluntary savings ratio and eventually the ISW.

The effect of mortality on ISW is manifested through both intentional and accidental bequests. Other things being equal, the higher the intentional bequests vis a vis the voluntary savings, the higher the ISW. Similarly, the higher the mortality, the higher the ISW. A reduction in mortality makes accidental bequests less

Figure 3: The impact of changes in longevity, fertility, and annuity on inherited share of wealth (ISW)



Source: Onder and Pestieau (2016b).

Notes: Horizontal axis shows the mortality rate ( $\pi$ ) in the left panel and fertility rate ( $n$ ) in the right panel. In both cases the vertical axes show the annuity values ( $a$ ). The contour curves show the iso-ISW values, and a move from dark blue to light yellow denotes an increase in the ISW.

likely, but more sizable. To see this, note that a decrease in mortality pushes up voluntary savings in order to finance consumption in a longer (expected) life. Thus, those who die early leave larger bequests. However, this happens less frequently after the reduction in mortality. In the end, the frequency effect dominates the size effect, and total accidental bequests decrease. Intentional bequests also decrease vis a vis voluntary savings in this case. However, this effect is relatively small as compared to the direct effect of mortality. As a result, bequests grow less than proportionately in comparison to voluntary savings, and ISW decreases.

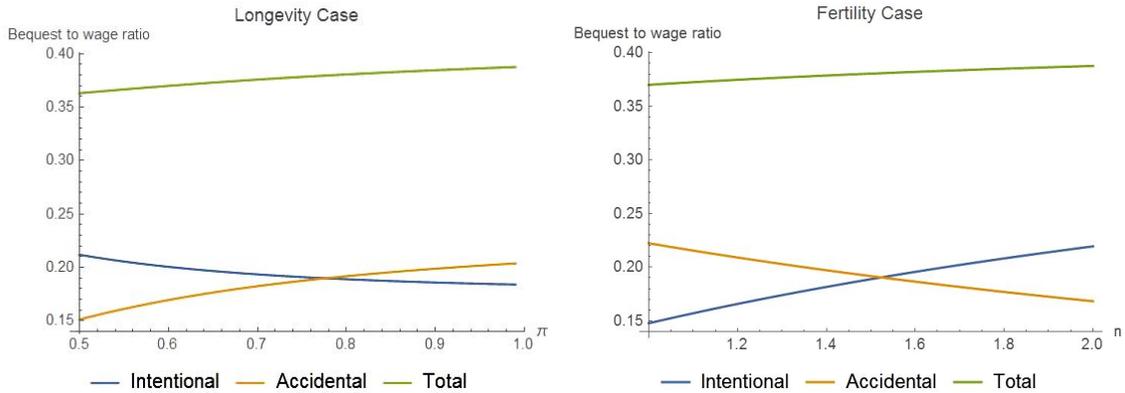
**Result 5.** *The inherited share of total wealth (ISW) decreases with a rise in annuities.*

As it appears clearly from Figure 3, an increasing annuitization of wealth at retirement leads to a decrease in inherited share of wealth. This follows from the observation that annuities and voluntary savings are close substitutes in financing the second period consumption. An increase in annuities leads to a reduction in voluntary savings (but its effects on intentional bequests is ambiguous). This affects both the aggregate wealth and the inherited wealth through accidental bequests. Overall, the effect on accidental bequests dominates and the ISW decreases with a rise in annuities. Such a trend was indeed prominent in the post-war era in most advanced countries, where pensions coverage with defined benefits increased rapidly. Thus, this result suggests that an increase and a subsequent decrease in annuitization could help explain the U-shaped pattern of inherited share of total wealth observed within the last half-century.

**Result 6.** *Aging leads to an increase in the size of accidental bequests and a decrease in intentional bequests vis a vis real wages.*

This result concerns the size of accidental and/or intentional bequests re-

Figure 4: The impact of changes in longevity, fertility on inheritance to wage ratios (RIW)



Source: Onder and Pestieau (2016b).

Notes: Horizontal axis shows the mortality rate ( $\pi$ ) in the left panel and fertility rate ( $n$ ) in the right panel. In both cases the vertical axes show the RIW.

ceived by a single child in comparison to her real wage. Figure 4 shows our simulation results.

As accidental bequests are the savings that were intended for the parent's old age consumption but split among the children after the parent's early death, a decrease in number of children has a direct positive effect on how much each child receives. In addition, it has indirect effects. For instance, it affects the parent's decision to save for future consumption. Taking into consideration the utility she receives from leaving accidental bequest, which is a function of inheritance received by each child and total number of children, the parent adjusts her voluntary savings down when she has fewer children. Another indirect effect, which follows from the former one, is the decrease in wages and interest rates that are brought by the decrease in savings. Overall, the direct effect and wage adjustment together dominate indirect adjustments, and accidental bequest to wage ratio increases when fertility rate goes down.

Lower fertility also has a direct negative effect on intentional bequests. Like

in the case of accidental bequests, the utility received by a parent from leaving intentional bequest is a function of inheritance received by each child and total number of children. Thus, the parent adjusts her total intentional bequests down when she has fewer children, and this adjustment is larger than those occur in voluntary savings. Overall, when combined with higher wages, the intentional wage to wage ratio decreases.

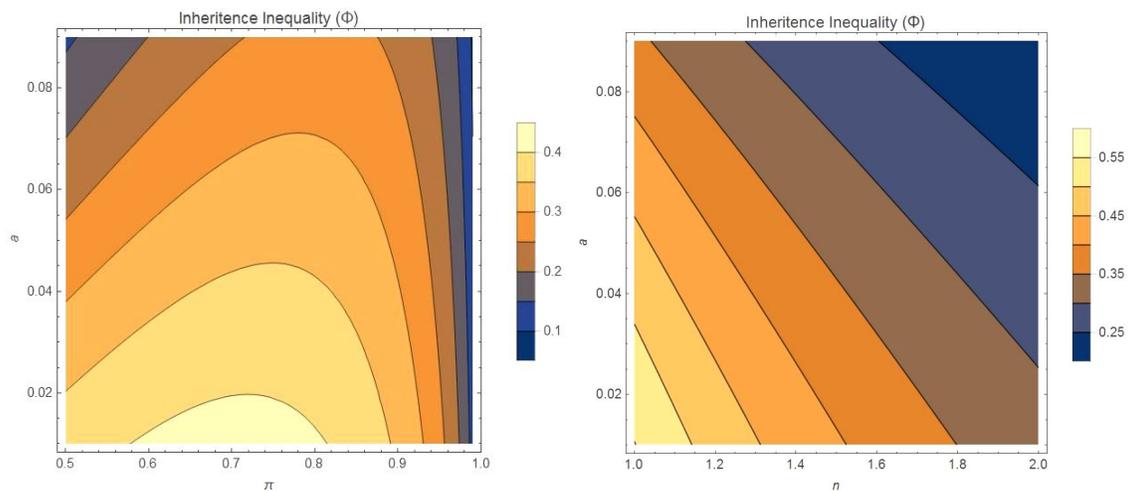
The effects of mortality changes on bequests work in similar ways, but it has additional channels. A decrease in mortality leads to an increase in voluntary savings because consumption needs in old age become more likely and annuity benefits become lower. It also increases the wages with savings, but this is a second order effect. Overall, since savings are higher, early deaths generate larger bequests in comparison to wages.

Finally, a decrease in mortality affects intentional bequests less than accidental ones. This follows from the fact that voluntary savings increase because both survival probabilities become higher and annuity receipts become smaller. In comparison, intentional bequests respond only to the former. Overall, both kinds of savings lead to an increase in wage, however, since the change in intentional bequest is small, the intentional bequest to wage ratio decreases with lower mortality.

**Result 7.** *A decrease in fertility increases inheritance inequality (IWI). The effect of mortality, however, is not monotonic: starting from high levels, a reduction in mortality initially increases the IWI; however, the IWI eventually starts decreasing as mortality becomes low enough.*

Intuitively, a decrease in fertility reduces both accidental bequests (through voluntary savings) and intentional bequests. However, the impact on the latter is larger. Therefore, although the average inheritance size decreases, the dispersion between the two types inheritances (a large one that comprise both accidental and intentional bequests and a small one with only intentional bequests)

Figure 5: The impact of changes in longevity, fertility, and annuity on inherited wealth inequality (IWI)



Source: Onder and Pestieau (2016b).

Notes: Horizontal axis shows the mortality rate ( $\pi$ ) in the left panel and fertility rate ( $n$ ) in the right panel. In both cases the vertical axes show the annuity values ( $a$ ). The contour curves show the iso-IWI values, and a move from dark blue to light yellow denotes an increase in the IWI.

Table 1: Summary of results: the effects of aging on indicators of inherited wealth

	Declining fertility		Increasing longevity	
	With annuities	Without annuities	With annuities	Without annuities
Inherited share of wealth (ISW)	–	–	–	–
Intentional inheritance to real wage ratio (RIW-intentional)	–	–	–	No effect
Accidental inheritance to real wage ratio (RIW-accidental)	+	+	+	No effect
Inherited wealth inequality (IWI)	+	+	+/-	+/-

increases because the smaller one decreases faster.

The effect of a change in mortality on inequality of inheritance depends on the size of mortality. With lower mortality, accidental inheritance becomes less frequent but larger as voluntary savings increase. Thus, both the mean and variance of total bequests could increase or decrease depending on the exact values.

Table 1 summarizes our findings, where a positive sign denotes an increase in each indicator and a negative sign denotes a decrease.

## 4 Conclusion

The purpose of this paper was to study the role, if any, that aging may have played in the upward trend exhibited by the inherited wealth in recent decades. We also wanted to check whether the annuitization provided by defined benefits pension systems could also explain this phenomenon. The conclusion is that aging, that is lower fertility and higher longevity, is not likely to explain the current bequeathing behavior whereas annuitization could. Finally, a caveat is in order. In this exercise we have focused on two types of bequests, those relying on the absence of perfect annuity markets and those arising from some joy of giving. Implications of demographic aging may be different for other motives of bequeathing such as pure altruism and exchange.

## References

- [1] Kaplan, S. N. and Rauh, J, (2013) It's the market: The broad-based rise in the return to top talent. *The Journal of Economic Perspectives*, 27(3), 35-55.
- [2] Leroux, M-L, P. Pestieau and G. Ponthière, (2011) Longevity, Genes and Efforts: An Optimal Taxation Approach to Prevention, *Journal of Health Economics*, 30, 62-76,
- [3] Munnell, A., J. Aubry and C. Crawford (2015) How has shift to defined contribution plans affected saving, *Retirement Research*, Number 15-16.
- [4] Onder, H. and P. Pestieau (2016a) Aging and wealth transfers, unpublished
- [5] Onder, H. and P. Pestieau (2016b) The effects of aging and annuitization on inherited wealth, unpublished
- [6] Piketty T.,(2014), *Capital in the 21st Century*, Harvard University Press, Cambridge.
- [7] Piketty, T. and G. Zucman, (2014a), *Wealth and inheritance in the long run*, in *Handbook of Income Distribution* North Holland, vol 2.
- [8] Piketty, T. and G. Zucman, (2014b), *Capital is back : wealth-income ratios in rich countries 1700-2010*, *Quarterly Journal of Economics*, 1255-1310
- [9] Weil, D. (1996) *Intergenerational transfers, aging, and uncertainty*, in *Advances in the Economics of Aging* Volume Author/Editor: David A. Wise, editor Volume Publisher: University of Chicago Press
- [10] Zhang, Junsen, Zhang, Jie and R. Lee, (2001), *Mortality decline and long-run economic growth*, *Journal of Public Economics*, Elsevier, vol. 80(3), 485-507